

## **APPLICATIONS OF WORLD WIDE WEB TECHNOLOGIES TO ENVIRONMENTAL PROBLEM SOLVING**

*The World Wide Web has experienced explosive growth. The impacts of Web-based information technologies on the ways environmental assessments are done and decisions are made are as important as their impacts in other areas of society. EAD is providing leadership in applying World Wide Web technologies to solving federal sector environmental problems.*

### **■ PROBLEM/OPPORTUNITY**

Environmental assessments and decision making are based on environmental data. In the last decade, the technological changes in environmental data acquisition, management, analysis, and communication have been astounding. The changes have been driven by relentless advances in sensor technologies, positioning systems, computational capabilities, and, most recently, the World Wide Web. These technological advances allow for innovations in the way environmental work is implemented. The federal sector has lagged behind technology in the environmental arena, thus giving EAD the opportunity to assist federal agencies as they struggle to take advantage of new Web technologies. The challenges for EAD are to stay abreast of technological change in the private sector, identify areas in which it can contribute to this change through applied research and development, and make use of the technological advances to change the ways in which environmental assessments are done and decisions are made.

### **■ APPROACH**

EAD uses a variety of Web tools to solve environmental challenges. Many are commercial products, while others are developed by EAD. For example, in the area of databases, EAD relies on Access for "light" database development work and on Oracle for projects that require an "industrial-strength" database engine. Connections to Web sites for dynamic, interac-

tive database access are accomplished through products such as Cold Fusion and DbAnywhere. EAD's geographical information system (GIS) capabilities include Arcinfo, Arcview, Intergraph, MapInfo, and Autocad products. However, for serving GIS data sets over the Web, EAD uses its own Maps and Data (MaD) browser, a Java applet that makes GIS coverages and associated data tables available through standard Web browsers. EAD's supporting Web server hardware includes Solaris and Windows NT workstations with RAID disk systems to protect against hardware failure.

Of greater importance than software or hardware are EAD's staff resources. In the Web area, where technological change in the private sector occurs so rapidly, EAD must not only create new technologies but creatively apply existing and emerging technologies to federal sector environmental problems. This requires a skill set that is one of EAD's unique strengths. EAD staff have technical expertise in disciplines such as environmental engineering, human and ecological health risk analysis, policy formulation, hydrogeologic software, and information sciences. EAD's staff also includes database specialists, GIS technical experts, Web site designers, and Java programmers. Capabilities found in other Argonne divisions (such as high-performance computing, Oracle design, and system network design) complete EAD's resource base.

## ■ APPROACH

EAD's Web work permeates the entire range of EAD projects. These include hazardous waste site characterization and remediation; technology transfer; policy formulation; environmental impact statement (EIS) development and dissemination; infrastructure cataloging and maintenance; environmental monitoring; modeling code dissemination, training, and education; emergency response; and project management. Although EAD Web sites sometimes support information dissemination, in more cases, they are dynamic, working sites that support the immediate technical needs of projects. Sponsors for this work include the U.S. Department of Energy (DOE) and U.S. Department of Defense (DoD).

EAD's Web work has pushed the technological envelope. For example, EAD's MaD browser allows users to employ live maps within commercially available Web browsers such as Netscape and Explorer. It is currently in the process of commercialization. EAD's use of Web sites to facilitate real-time site characterization and remediation work has changed the way such work is conducted. EAD is currently working on a prototype nuclear, biological, and chemical (NBC) attack warning system that will change the way battlefields are monitored for NBC threats. The system is built around in-field sensors, satellite data transmission, Oracle database systems, and dynamic Web sites. EAD is working with the Museum of Science and Industry in Chicago to transform the way children learn about their local environment; they collect soil samples and map and upload their results through a specially designed Web site.

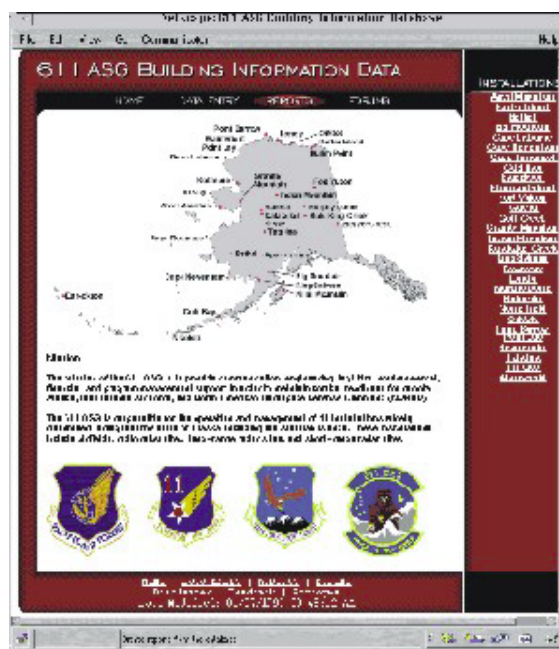
EAD's Web work has garnered awards. One of the first Web sites completed by EAD to support characterization work at a DOE site was awarded a DOE Pollution Prevention Award for the way it changed the nature and outcome of the work. The Web site designed to support the depleted uranium hexafluoride (UF<sub>6</sub>) EIS received an award from *U.S.A. Today* for the role it played in informing the public about the potential risks associated with depleted UF<sub>6</sub>.

## HISTORY/STATUS/FUTURE

EAD's application of Web technologies to environmental challenges has grown steadily over the last several years. For example, the number of Web sites supporting technical projects has grown from 6 in 1996 to more than 40. Use of these sites has grown just as dramatically, with yearly hits increasing from about 20,000 in 1996 to almost 200,000 in 1998. Programmatic growth in this area will likely continue. The 611 Air Support Group (ASG) Web site is used for tracking cultural and historical resources at 611 ASG facilities. As a part of the national laboratory system, EAD must provide leadership in using Web technologies to improve the ways in which environmental assessments and decision making are conducted.

## ■ COMMUNICATION OF RESULTS

EAD's work in the area of environmental data management and communication is disseminated in a variety of ways, including conferences, workshops, and reports. Because most of the current work involves a Web component, the actual Web sites have become vehicles for showcasing EAD's accomplishments in this area.



Argonne's MaD browser provides on-line, interactive access to dynamic maps and databases.